National Transportation Safety Board
Office of Railroad, Pipeline and Hazardous Materials
Washington, DC 20594

RRD22FR011

RAIL

Group Chair's Factual Report

December 22, 2022

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A. ACCIDENT

Location: Oakland, California
Date: July 15, 2022
Time: 11:01 a.m. (Pacific Daylight Time)
Vehicle: UP Roadway Maintenance Machine, Pettibone Speed-Swing (SS007)
Train: National Railroad Passenger Corporation (Amtrak) Train 531

B. RAIL GROUP

IIC	Ruben Payan NTSB/ IIC
Group Chair	Robert Gordon NTSB/ Roadway Worker Protection-Track and Engineering
Group Chair	Zach Zagata NTSB/Operations
Group Chair	Greg Scott NTSB/Signal and Train Control

C. SUMMARY

On July 15, 2022, at 11:01 am (PDT) Amtrak train 531 (15) operating with lead unit CDTX 2009 and five bi-level cars struck an occupied Union Pacific (UP) hi-rail equipped roadway maintenance machine (RMM)/speed -swing. Thirty-one passengers and four Amtrak personnel were aboard the train at the time of the accident. One passenger reported back pain and was transported to a local hospital. The conductor and assistant conductor also reported minor injuries and were treated at the scene. The operator of the RMM was transported to a local hospital with life threating injuries.

At the time of the incident the RMM was fouling the UP main track 2 at 50th Avenue in Oakland, CA (MP 10.77) on the UP Niles Subdivision. Train 531 was operating south (per timetable) on main track 2. The PTC onboard logs indicate the

train was traveling 68 mph, when the engineer initiated an emergency brake application. The locomotive image recorder determined the train horn was activated on approach to the grade crossing. The RMM was destroyed, and the collision resulted in extensive damage to locomotive CDTX 2009 which included a fuel tank puncture and fuel release.

D. DETAILS OF THE INVESTIGATION

1.0 Description of UP Niles Subdivision

The Niles Subdivision extends from milepost 2.3 (10th street) to milepost 35 (Newark) in a timetable east-west direction. The subdivision consists of mostly two main track territory. Maximum authorized timetable speed is 79 mph for passenger trains. In the vicinity of the accident area, UP authorizes train movements with a traffic control signal system. Train movements are coordinated by a UP dispatcher located at the UP dispatch center in Omaha, Nebraska.

2.0 The Accident

On the day of the accident, the crew went on duty at 8:00 am in Sacramento, California for Amtrak train 531 and held a job briefing. During postaccident NTSB interviews the engineer told investigators they departed on time, and it was an uneventful trip prior to the accident. After stopping at Jack London Square, Amtrak train 531 departed a few minutes late and proceeded to Coliseum station. During the trip Amtrak train 531 made about nine previous stops to load and unload passengers. The engineer stated there was a permanent 15-mph speed restriction at the Coliseum

station track and he made a 10-psi brake pipe reduction. He said he went through a series of crossings on main track 2 and was approaching 50th street when he came around a curve and could see a MOW piece of equipment about ¾ of a mile away on main track 1. The engineer told investigators that the equipment appeared to be stopped and it was common to see equipment stopped on adjacent tracks. He said he was going about 65 mph at this time, and everything seemed normal.

A review of event recorder data indicated that at 11:01:02 local time, the engineer started his whistle sequence with the 1st long whistle sequence. The engineer said during the second long, he noticed that the equipment on main track 1 began to move straight and then all the sudden the equipment began to turn left. He said at that point he began setting air and going into emergency. Within 1 to 2 seconds the impact occurred, and the locomotive rocked to the left as the engineer was attempting to place the train into emergency. The engineer told investigators that due to the impact he couldn't go into emergency right away and that the handle only went to the handle off position, but once he could reach it, moved it from handle off to emergency. A review of the forward-facing image recorder and event recorder data from the lead locomotive determined that from the time the speed swing made the movement towards main track 2 to the point of impact was about 3 seconds, and the train had traveled approximately 300 feet. After impact, Amtrak train 531 traveled around 1,594 feet before coming to rest. The engineer heard a foreman in a truck yell emergency, emergency, emergency, and he immediately dialed 911.

The dispatcher answered right away, and the engineer told him that they struck a MOW vehicle at the crossing. The engineer then began assessing damage and the assistant conductor was walking forward and said they were leaking fuel, so he got up and hit the emergency fuel cut-off. The engineer said after that he communicated with the dispatcher and the crew about the status of the passengers, he notified the dispatcher that fuel was leaking on the ground from the engineer's side of the locomotive. He said that dispatcher told him to evacuate the locomotive and the original plan was to evacuate the entire train, but it was determined that it was safe for everyone to go to the 5th car. He stated that emergency response arrived at the scene in approximately 5 minutes. The engineer said the police showed up first and then other responders arrived.

3.0 Forward Facing Camera and Event Recorder Data

Figure 1. Screenshot from forward facing camera of CTDX Locomotive No. 2009

On July 16, 2022, the operations investigative group conducted a review of the forward-facing image recorder data and event recorder data from lead locomotive CDTX 2009. A timeline was developed based on the group's observations:

- 11:01:02 – Begin 1st long whistle sequence at 3036 feet – Confirmed utilizing locomotive event recorder data by the operations group.
- 11:01:03 – End 1st Long whistle sequence at 2929 feet – Confirmed utilizing locomotive event recorder data by the operations group. Train speed was at 73 mph at this time – Confirmed with locomotive event recorder data by the operations group.
- 11:01:04 – Speed Swing in view on main track 1 with wheels parallel – Confirmed by use of the outward facing image recorder data by the operations group.
- 11:01:08 – Begin 2nd long whistle sequence at 2404 feet – Confirmed utilizing locomotive event recorder data by the operations group
- 11:01:09 – End 2nd long whistle sequence at 2301 feet – Confirmed utilizing locomotive event recording data by the operations group. Train speed was at 71 mph at this time – Confirmed utilizing locomotive event recording data by the operations group
- 11:01:11 – First visual movement of speed swing on the crossing at 50th Ave – Agreed and confirmed by utilizing outward facing image recorder data by the operations group.

- 11:01:13 – Sounding of short blast – Did not register on locomotive event recorder. This was agreed to be heard by all members of the operations group by utilizing the outward facing image recorder data.
- 11:01:13 – Speed swing makes movement towards main track 2 – Confirmed utilizing outward facing image recorder data by the operations group.
- 11:01:13 – Final long whistle sequence begins at 1894 feet – Confirmed utilizing locomotive event recorder data by the operations group.
- 11:01:16 – End final long whistle sequence upon impact with speed swing at 50th Ave 1594 feet – Confirmed by utilizing both locomotive event recorder and outward facing image recorder data by the operations group. Train speed was 68 mph at this time – Confirmed utilizing locomotive event recorder data by the operations group.
- 11:01:19 – Engineer-Initiated-Emergency at 65 mph at 1302 feet – Confirmed by utilizing locomotive event recorder data by the operations group.
- 11:01:29 unidentified employee made emergency call over the radio utilizing the words “Emergency, Emergency” – Confirmed by operations group utilizing outward facing image recorder data that recorded engineers use on radio.

- 11:01:38 – Dial tone back for 911 emergency call became audible. Confirmed by operations group by use of the outward facing image recorder data that picked up cab audio .
- 11:01:41 – Union Pacific dispatcher responds to emergency call – confirmed by operations group by utilizing audio from outward facing image recorder data.
- 11:01:45 – Train came to a stop at 0 mph at 3ft – Confirmed by locomotive event recorder data by operation group.

The operations group did not note any erratic or abnormal manipulations of the operating controls during the review of the event recorder data. The operations group did not take any exceptions to the train handling methods utilized by the engineer prior to the accident.

The operations group noted that during the review of the PTC I-ETMS logs and event recorder data, discrepancies were related to the headlight, horn, wheel diameter entered in the event recorder data. The following explains the discrepancies noted:

3.1 Headlight:

The locomotive event recorder contains a wiring anomaly whereas the Auxiliary Light channel will record high (on) and the Headlight channel will record low (off) while the Headlight Switch is on Bright and Auxiliary Light switch is illuminated. The locomotive light circuit is wired so that the Bright headlight circuit and Auxiliary light circuit are tied together. The practical application is explained as when the Auxiliary Light Switch channel shows as high, the headlight is displayed as bright. When the

Headlight channel shows high and the Auxiliary Light Switch shows low, the headlight is displayed as dim and the Auxiliary lights are off.

3.2 Horn:

Locomotive Horn is recorded by a pressure switch mounted on the pneumatic line that feeds the locomotive horn. As this is a sensor which senses an air pressure change, this mechanical sensor will wear with use. It is not uncommon for a pressure sensor to not completely sense a pressure increase in real time although a horn may be producing an audible sound. While approaching the 50th Ave crossing the first long blast of the horn is audibly heard for approximately two seconds while the event recorder shows slightly more than one second. The third blast of the horn was momentary, and while audible, was not detected by the event recorder.

3.3 Event Recorder Wheel Diameter Discrepancy:

CTDX 2009 had been previously modified with a Wabtec I-ETMS PTC system and a Wi-Tronix Violet/Wabtec FIRE event recorder system. The Violet system shows a default of the R2 wheel diameter as 40 inches. This measurement is unable to be adjusted within the DAS III event recorder software. The I-ETMS system regularly adjusts its internal wheel diameter calculation based upon GPS location and revolutions of the number 2 axle. The wheel diameter of the I-ETMS system was calculated as 40.39 inches. A physical measurement of the R2 wheel diameter, which was taken by a wheel gauge measuring from the tread to the witness mark was determined to be 40.25 inches. For this reason, the calculated I-ETMS speed was

determined to be the precise speed and was used to verify the speed recordings from the event recorder.

4.0 Union Pacific Radio Recordings

On July 17, 2022, the operations investigative group conducted a review of the radio transmissions immediately after the accident. The following timeline was developed based on the group's observations: (All times are Pacific Daylight Time)

- 11:01.40 Emergency transmission call by unidentified employee
- 11:01.48 UP Dispatcher 62 (DSPR) responds to the initial emergency transmission, 531 responds that they had struck UP vehicle
- 11:02.08 DSPR calls Track supervisor
- 11:02.11 Track supervisor responds to DSPR call
- 11:02.32 531 reported to DSPR stopped at MP 11
- 11:02.45 DSPR calls UP Risk Management Command Center (RMCC) for emergency response
- 11:03.42 Track supervisor communicates to DSPR that the equipment involved was a UP Speed Swing
- 11:03.42 Track supervisor communicates to DSPR that the equipment involved was a UP Speed Swing
- 11:03.42 Track supervisor communicates to DSPR that the equipment involved was a UP Speed Swing
- 11:03.55 Track supervisor requests emergency personnel
- 11:04.14 DSPR confirms employee injury to RMCC

- 11:05.48 RMCC confirms emergency response to DSPR
- 11:06.22 DSPR follows up with Track supervisor – no emergency response yet
- 11:06.39 531 reports fuel leak
- 11:06.49 Evacuation of equipment instruction given from DSPR to 531
- 11:07.24 Fuel leak/Evacuation order reported to RMCC
- 11:11.44 DSPR calls 531/Track supervisor – Asks if emergency response has arrived
- 11:11.49 Track supervisor responds no emergency response, 531 states they can hear sirens
- 11:12.32 531 Engineer reports that he will be moving to the Cab Car
- 11:12.46 Track supervisor reports Fire Department has arrived

5.0 Personnel Information

5.1 Locomotive Engineer

The locomotive engineer was hired on February 15, 2010, as a conductor, and was promoted to locomotive engineer on September 6, 2013. He was assigned to the extra board in Sacramento, California and operated over the Sacramento to San Jose route around 2-3 times a week on average.

A review of the engineer's training records indicated that he completed his last re-certification on May 13, 2021, and last engineer certification general knowledge exam on May 12, 2021.

A review of the engineer's discipline history indicated that the operator had not been disciplined in the last five years.

A review of the engineer's work history from 06/30/22 to 07/15/22 indicated that the operator had worked a total of 10 of the 16 days prior to the accident.

6.0 Operating Documents

The train crew is governed by the General Code of Operating Rules (GCOR), Seventh Edition, effective April 1, 2020, and System Special Instructions. The operating rules and supplements provided are as follows:

- Amtrak Service Standards Train Service & Onboard Service Employees, dated January 10, 2022
- Amtrak Employee Safety Rules, dated September 1, 2020
- General Track Bulletins
- General Notices and Order

7.0 Applicable Rule and Regulations

7.1 Title 49 Code of Federal Regulations (CFR) Subpart B - Use of Locomotive Horns

§ 222.21 When must a locomotive horn be used

(a) Except as provided in this part, the locomotive horn on the lead locomotive of a train, lite locomotive consist, individual locomotive or lead cab car shall be sounded when such locomotive or lead cab car is approaching a public highway-rail grade crossing. Sounding of the locomotive horn with two long blasts, one short blast and one long blast shall be initiated at a location so as to be in accordance with paragraph (b) of this section and shall be repeated or prolonged until the locomotive occupies the

crossing. This pattern may be varied as necessary where crossings are spaced closely together.

(b)

(1) Railroads to which this part applies shall comply with all the requirements contained in this paragraph (b) beginning on December 15, 2006. On and after June 24, 2005, but prior to December 15, 2006, a railroad shall, at its option, comply with this section or shall sound the locomotive horn in the manner required by State law, or in the absence of State law, in the manner required by railroad operating rules in effect immediately prior to June 24, 2005.

(2) Except as provided in paragraphs (b)(3) and (d) of this section, or when the locomotive horn is defective and the locomotive is being moved for repair consistent with section 229.9 of this chapter, the locomotive horn shall begin to be sounded at least 15 seconds, but no more than 20 seconds, before the locomotive enters the crossing. It shall not constitute a violation of this section if, acting in good faith, a locomotive engineer begins sounding the locomotive horn not more than 25 seconds before the locomotive enters the crossing, if the locomotive engineer is unable to precisely estimate the time of arrival of the train at the crossing for whatever reason.

(3) Trains, locomotive consists and individual locomotives traveling at speeds in excess of 60 mph shall not begin sounding the horn more than one-quarter mile (1,320 feet) in advance of the nearest public highway-rail grade crossing, even if the advance warning provided by the locomotive horn will be less than 15 seconds in duration.

8.0 General Code of Operating Rules (GCOR) Rule 5.8

5.8 Bell and Whistle Signals

5.8.1 Ringing Engine Bell

Ring the engine bell under any of the following conditions:

- Before moving, except when making momentary stop and start switching movements.
- As a warning signal anytime it is necessary.
- When approaching men or equipment on or near the track.
- Approaching public crossings at grade with the engine in front start signal at the crossing sign. If no sign, or if movement begins between sign and crossing, start signal soon enough before crossing to provide warning. Continue ringing bell until the crossing is occupied.

5.8.2 Sounding Whistle

The whistle may be used at anytime as a warning regardless of any whistle prohibitions.

When other employees are working in the immediate area, sound the required whistle signal before moving.

Other forms of communications may be used in place of whistle signals, except signals (1), (7), and (8). See following chart.

The required whistle signals are illustrated by "o" for short sounds and "—" for longer sounds:

Sound		Indication
(1)	Succession of short sounds	Use when persons or livestock are on the track at other than road crossings at grade. In addition, use to warn railroad employees when an emergency exists, such as a derailment. When crews on other trains hear this signal, they must stop until it is safe to proceed.
(2)	—	When stopped: air brakes are applied, pressure equalized.
(3)	— —	Release brakes. Proceed.
(4)	o o	Acknowledgment of any signal not otherwise provided for.
(5)	o o o	When stopped: back up. Acknowledgment of hand signal to back up.
(6)	o o o o	Request for signal to be given or repeated if not understood.
(7)	— — o —	When approaching public crossings at grade with the engine in front, sound signal as follows: A. At speeds in excess of 45 MPH, start signal at or about the crossing sign but not more than 1/4 mile before the crossing. B. At speeds of 45 MPH or less, start signal at least 15 seconds, but not more than 20 seconds, before entering the crossing. C. If no crossing sign start signal at least 15 seconds, but not more than 20 seconds before entering crossing but not more than 1/4 mile before the crossing. D. If movement starts less than 1/4 mile from a crossing, signal may be sounded less than 15 seconds before the crossing when it is clearly seen traffic is not approaching the crossing, traffic is not stopped at the crossing or when crossing gates are fully lowered. Prolong or repeat signal until the engine completely occupies the crossing(s).
(8)	— o	Approaching men or equipment on or near the track, regardless of any whistle prohibitions. After this initial warning, sound whistle signal (4) intermittently until the head end of train has passed the men or equipment.

9.0 External Oversight

In June of 2020, as part of an agency restructuring, FRA transitioned eight regional leadership teams into nine Safety Management Teams to serve as the Office

of Railroad Safety's main liaison with the senior leadership of the Nation's railroads. Each of the nine safety management teams is assigned to Class I railroads or a group of railroads and provides safety oversight of the respective railroad system(s). The nine-safety management teams are:

- SMT-1: Amtrak, commuter, and excursion railroads in the eastern section of the Nation.
- SMT-2: Short Line East
- SMT-3: Norfolk Southern
- SMT-4: CP/CN/CCD
- SMT-5: BNSF
- SMT-6: UP/KCS
- SMT:7: Commuter and excursion railroads in the western section of the Nation
- SMT-8: Short line railroads operating in the western section of the Nation
- SMT-9: CSX

The Safety Management Teams represent FRA with the railroads, and they communicate and coordinate with FRA's Staff Directors, Accident Analysis Branch, Audit Management Program, and other Safety Management Teams. To carry out its mission, FRA staff includes about 400 Federal safety inspectors and specialists, as well as approximately 200 state inspectors who are spread throughout the US. Safety inspectors focus primarily on five safety disciplines when conducting inspections for compliance and enforcement; those disciplines are:

- Hazardous Materials
- Motive Power and Equipment
- Operating Practices
- Signal and Train Control
- Track

10.0 Operational Testing/Internal Oversight

On November 25, 1974, the Federal Railroad Administration (FRA) provided notice of intent to move forward with the proposed rulemaking for Part 217-Railroad Operating Rules. Within Part 217, FRA codified internal oversight for railroad operations by establishing minimum requirements for railroads to conduct periodic tests and inspections to determine the extent of compliance with operating rules and timetable special instructions. Title 49 Code of Federal Regulations (CFR) Section 217.9 requires that every railroad have a written program of operational tests and inspections in effect. Employees are tested on various aspects of their job to evaluate their ability to perform their jobs correctly and their knowledge of company rules and federal regulations. This testing not only evaluates the worker's skills and overall ability to perform a task safely and correctly, it also reinforces compliance with rules.

A railroad's operational testing program on file with FRA must, at a minimum:

1. Provide for operational testing and inspection under the various operating conditions on the railroad, at various times, and at a variety of locations.
2. Address with particular emphasis those operating rules that cause or are likely to cause the most accidents or incidents, such as those accidents or incidents identified in the quarterly reviews, 6-month reviews, and annual summaries.
3. Require a minimum number of tests and inspections per year covering the requirements of 49 CFR Part 218, Subpart F.

4. Describe each type of operational test and inspection required, including the means and procedures used to carry them out.
5. State the purpose of each type of operational test and inspection.
6. State, according to operating divisions where applicable, the frequency with which each type of operational test and inspection is to be conducted.
7. Identify by name, job title, and division or system, the railroad manager who is responsible for ensuring that the program of operational tests and inspections is properly implemented.
8. Require a record of the date, time, place, and result of each operational test and inspection that was performed in accordance with the railroad's program.
9. Require a record that specifies the railroad manager that performed the operational test or observation and each employee tested.
10. Mandate a review of operational testing results and require adjustments to the program of operational tests accordingly.
11. Mandate a quarterly review when regulations require.
12. Mandate a 6-month review when regulations require.

As a result of the requirements, Amtrak conducts tests and observations of its employees in accordance with federal regulations to determine their level of compliance with railroad operating rules. NTSB investigators reviewed Amtrak's

efficiency testing program and requested specific data regarding efficiency tests for the crew.

The Amtrak program contains specific information for testing officers to be used when setting up and conducting tests. Federal regulations require that each test be described in the program including the means and methods used to conduct the tests. Amtrak has established a program of operational testing which contains the required information by regulation which is needed to maintain consistency among its testing officers. A review of the efficiency testing results for the revealed the following:

From January 2, 2021, through June 18, 2022, the engineer had been observed during operational testing by 9 supervisors on 29 occasions. The supervisors recorded a total of 151 operational tests and the engineer had been found to comply with all 151 rules and procedures observed by the supervisor.

11.0 Roadway Work Group

The three-member roadway work group consisted of a roadway worker in charge (RWIC) and two equipment operators. The work group was assigned to work with the Alameda County Regional Auto Theft Task Force (ACRAT) to recover stolen/abandon automotives on or near the railroad right of way. This was to be accomplished utilizing a speed-swing roadway maintenance machine and a backhoe from the railroad. The task force had arranged for a tow truck to aid in the effort. The RWIC and the speed-swing operator were both employed as Track Supervisors/Inspectors. Their regular schedule requires yard or industry inspections on

Fridays, however, there inspection frequencies were up to date, allowing them to be assigned to work with the ACRATT. The work had been planned for about one week.

12.0 The Auto Theft Task Force

The subject roadway work group was working in coordination with the Alameda County Regional Auto Theft Task Force (ACRATT). According to a letter from the Alameda County District Attorney's Office dated May 18, 2020, the ACRATT was created to reduce the incidents of vehicle theft in Alameda County through proactive enforcement efforts, officer training and public awareness. ACRATT is governed by a Task Force Oversight Committee which consists of the Chiefs of the participating local agencies or their designees and the Commanders of the participating California Highway Patrol entities, or their designees.

The ACRATT consists of five agencies: California Highway Patrol, Golden Gate Division, California Highway Patrol, Oakland Area, California Highway Patrol, Hayward Area, Oakland Police Department, and Alameda County Probation Department. A Memorandum of Understanding was jointly signed to enforce the laws of the State of California as the relate to vehicle theft so as to reduce the occurrence of vehicle theft in Alameda County.

13.0 Roadway Work Prior to the Accident

Investigators interviewed the RWIC and backhoe operator to understand the job safety briefing and work leading up to the accident. The RWIC stated that following a morning safety call, he conducted a job briefing outlining the planned work for the day.

The job briefing was conducted at about 10:00 a.m. After the job briefing was complete, each member of the work group made their way to the 50th Avenue crossing where the work was to take place.

The RWIC and backhoe operator traveled by highway to the location. The RWIC secured track authority from the train dispatcher granting exclusive track occupancy for the movement of the speed-swing by rail on main track one. The RWIC stated that the plan was for the workers to travel the 50th Avenue crossing and wait for further instruction. The RWIC stated that he told the speed-swing to remain on main track one until he arrived. He told investigators that he planned to get a track authority on main track two to protect the auto recovery work.

The backhoe operator stated that he had arrived at 50th Avenue crossing about 30-40 minutes before the speed-swing arrived. After arriving at the location, he parked the backhoe on the west side of the house track that was adjacent to main track one. He remained in the backhoe and was eating his lunch when he noticed the speed-swing arrive on main tack one. He was not looking at the speed-swing when the accident occurred but recalled hearing the collision and seeing the results of the impact.

14.0 Speed-Swing

The roadway maintenance machine that was struck was a Speed-Swing Model No. 445E manufactured by Pettibone. UP designated the speed-swing as No. SS007. A speed-swing is a piece of equipment used for lifting and moving material, in this case, the equipment was to be used to move stolen/abandoned vehicles from the

railroad right-of-way. The last recorded safety inspection of the subject speed-swing was on March 28, 2022. The was no record of a daily equipment inspection for the day of the accident found in the UP daily maintenance and inspection for work equipment log for the speed-swing that was recovered near the wreckage. The functional state of the equipment could not be determined due to accident damage.

Figure 3. Speed-swing SS-007 as found following impact and extrication.

15.0 Track Description

The Union Pacific (UP) Niles subdivision consists of 30.75 miles of double main track between milepost 4.25 and milepost 35.0. According to UP documentation, the total tonnage figure for the Niles subdivision was about 7.8 million gross tons. On average there are 18 trains that operate daily over the Niles subdivision.

Generally, the main track leading up to the accident location was constructed with crossties that measured 9-inches by 7-inches by 8-feet 6-inch long, spaced 19.5 inches on center (nominal). On the main track, track is constructed of continuous welded rails were fastened to the crossties using standard double shoulder tie plates fastened with spikes on each rail. The track was supported by granite rock ballast.

Traveling on main track, the southbound train traversed an ascending grade ranging from .06% to .34%, approaching the subject crossing. The curvature of the main tracks leading up to the POC was .5 degree.

16.0 Roadway Worker Training and Qualification

According to information provided by UP, the speed-swing operator was first qualified to operate the speed-swing in July 2007. UP provides training for operators titled Engineering Services Roadway Maintenance Machine Training; this is a web-based training module. The speed-swing operator last completed this training in May 2021. UP representatives confirmed that the May 2021 training did not include any instruction regarding safety when occupying or operating over high-way rail grade crossings. UP provides their employees with a Job Safety Analysis (JSA) instructions for various task. Operating on-track equipment is covered by JSA-E2-2009. Any reference to safety around highway/rail grade crossing is related to equipment spacing and protecting highway users.

17.0 Mechanical Information for amtrak-531-15

Figure 4. Photo of locomotive CDTX 2009 from Train 535-15 taken after the accident.

The southbound passenger train consisted of one forward facing locomotive at the front of the train, four coach cars, and one cab car at the rear of the train. The passenger train was carrying 31 passengers and 4 Amtrak employees consisting of 1 engineer, 1 conductor, 1 assistant conductor, and 1 food service employee. The train was a total of 484 feet long and weighed a total of 578 tons.

1. CDTX 2009 Fwd. EMD F59PHI Built 1994

2. CDTX 8016 Morrison-Knudsen California Coach Car I Built 1995

3. CDTX 8014 Morrison–Knudsen California Coach Car I Built 1998

4. CDTX 8814 Morrison–Knudsen California Diner Car 1 Built 1997

5. CDTX 6461 Alstom California Coach Car II Built 2001

6. CDTX 6964 Rev. Alstom California Cab Car II Built 2001

18.0 Pre-Departure Inspections

On July 15, 2022, prior to the first morning departure, a class I brake test was conducted on train 531-15 by Amtrak qualified maintenance persons at Oakland, CA. Additionally, the locomotive received a daily inspection, and the passenger cars received interior/exterior calendar day inspections during the evening of July 14, 2022, prior to the first morning departer, also by Amtrak qualified maintenance persons in Oakland, CA. All inspections and tests were completed in accordance with 49 CFR parts 229 and 238.

19.0 Equipment Post Accident Inspections

On July 16, 2022, an FRA Motive Power & Equipment Supervisor performed a compliance inspection of the equipment involved in the collision. The equipment was staged at the Amtrak Maintenance Facility in Oakland, CA. Minor deviations of Federal Regulations were noted on an inspection report and provided to Amtrak. The non-complying conditions consisted of improper securement of the equipment at the Amtrak facility, improperly sealed side door bypass switch, and improperly executed (inspection dates missing) locomotive inspection record, Form FRA F 6180.49A.

On July 17, 2022, the FRA MP&E Supervisor returned to the Amtrak Maintenance Facility to observe a train brake test and locomotive warning devices functionality tests. A class I brake test on the train was observed and completed, however, because the lead locomotive involved in the collision (CDTX 2009) was heavily damaged, the engine could not run and be used to generate air into the brake system. Instead, a helper locomotive was connected to the train's brake pipe and used to pressurize the brake systems, while CDTX 2009 was cut-in as the controlling locomotive for the purpose of operating the brakes. The brakes applied and released without exception and the brake components showed normal wear patterns. No exceptions were taken.

Also tested at this time were the locomotive warning devices, this included the horn, bell, alerter, headlights, and auxiliary lights. The locomotive horn tested successfully and was responsive when the horn button was depressed, as did the locomotive bell when the horn sounded, or the bell switch was activated. The alerter was tested (audio and visual), would reset when provided a reset signal, and initiated a penalty brake application when the timing cycle expired. The headlights was tested and illuminated when the headlight switch was turned to the "Dim" and "Bright" positions, however, the auxiliary lights were unable to be tested. The collision caused damage to the right front auxiliary light lamp, housing, and wiring cable, making a test of the auxiliary lights impossible without additional repairs to the system. Those warning devices noted that were able to be tested, operated as intended.

20.0 Highway/rail grade crossing warning devices

On Friday July 15, 2022, FRA conducted an extensive post-accident operational inspection of the 50th Avenue crossing warning devices including a review of the circuit plans, shunt tested both southbound and northbound approaches on main track 1 and main track 2 as well as completing island shunt tests on both tracks. Operational tests were performed on all gate mechanisms, front/back flashing lamp units, and the grade crossing predictors (Safetran GCP 3000 D2). A review of the programming for the GCP 3000's for both tracks was also performed. Inspectors also performed grounds tests on all equipment to verify there were no foreign currents on any of the crossing equipment. No exceptions were taken on the operation of the crossing warning devices.

NTSB investigators reviewed the crossing downloads on Saturday July 16th for both main 1 and main 2. It was determined that Amtrak 531 had a 28 second warning time, operating on main 2, before entering the island circuit at the 50th Avenue at the time of the accident. While review the downloads of both island circuits it was determined that there was 14 seconds from the time the operator of the Speed Swing lifted (loss of shunt) the rail gear wheels, on Main 1 island circuit, until train 531 entered the island circuit on main 2. Although investigators have visually reviewed the downloads, they do not have a copy of those downloads.

A copy of the downloads, 6 months FRA inspection records, 6 months trouble logs, and circuit designs were requested and reviewed with no issues found.

21.0 Sight distance observation

At the accident location, the maximum authorized train speed is 79 mph for Amtrak passenger trains and 60 mph for freight trains. Investigator determined that from the crossing, southbound trains could be seen at least back to Control Point East Oakland MP 9.6. The team determined that the minimum sight distance purview was over 1 mile.

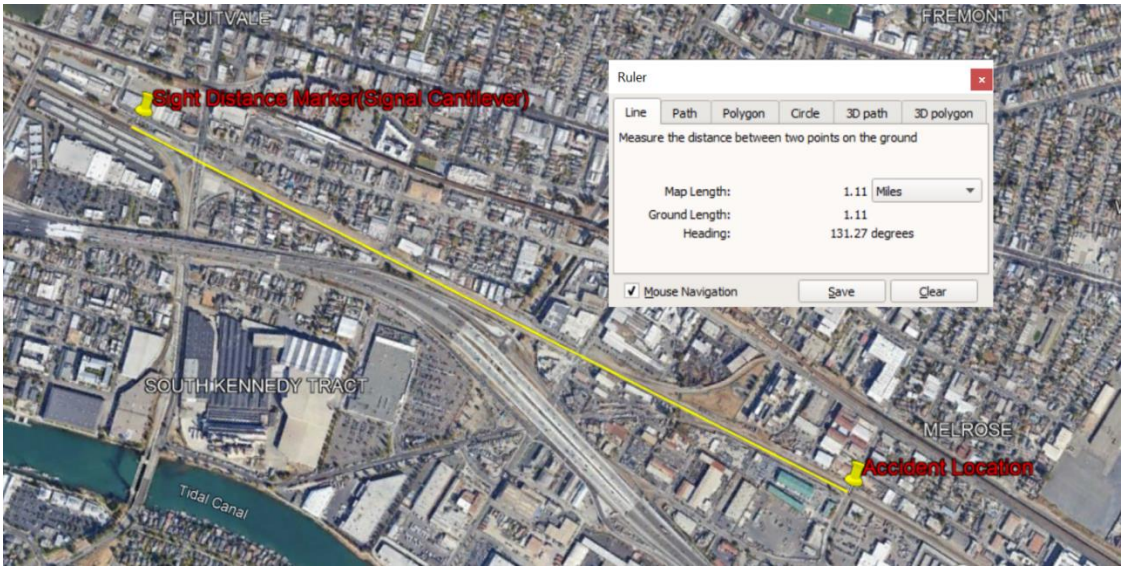

Figure 5. Google Earth image showing sight distance estimation.